PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2005-039435

(43)Date of publication of application : 10.02.2005

---

(51)Int.Cl. H03B 5/32
H03H 9/02

---

(21)Application number : 2003-198714 (71)Applicant : TOYO COMMUN EQUIP CO LTD

(22)Date of filing : 17.07.2003 (72)Inventor : ISOHATA KENSAKU

---

(54) SURFACE-MOUNTED PIEZOELECTRIC OSCILLATOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a surface-mounted type piezoelectric oscillator which is adaptive to size reduction and reduces an influence of thermal strain.

SOLUTION: A projection part 7a projecting nearly in the center of one main surface (top surface) of a printed wiring board 7 and an annular collar part 7b formed at the peripheral edge of the other main surface (reverse surface) are formed in one body; and at least a crystal vibrator 2 and an electrode pad 6a for mounting an electronic component 5 for an adjusting circuit are arranged on the top surface of a projection part 7a and a shield layer 6c is arranged at an internal-layer part corresponding to at least the projection par t 7a. An electrode pad 6b for mounting an electronic component 3 for an oscillation circuit and an electronic component 4 for a compensating circuit is arranged on the top surface of the collar part 7b, and an external terminal 6d which is electrically connected to the electrode pads 6a and 6b, and the shield layer 6c is arranged on the other main surface of the collar part 7b. After the crystal vibrator 2 and an electronic component group are mounted on the electrode pads 6a and 6b, the projection part 7a where at least the crystal vibrator 2 and electronic component 5 for the adjusting circuit

are mounted is covered with a cover 8.

LEGAL STATUS [Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]

[Claim 1]

It is a piezoelectric transducer at least,

Electronic parts for oscillator circuits for constituting an oscillator circuit,

Electronic parts for equalization circuits for constituting an oscillation frequency equalization circuit,

The printed-circuit board for mounting said piezoelectric transducer and said electronic-parts group,

It has metal covering which has the crevice which carries out opening caudad,

The surface mount mold piezo oscillator which has the structure which forms the flange which equips the principal plane of another side with an external terminal while forming in the heights and this heights periphery which protrude on one principal plane of said

printed-circuit board, mounts said piezoelectric transducer and said electronic parts for equalization circuits in these heights at least, and covers the upper part of these heights with said covering.

[Claim 2]

The surface mount mold piezo oscillator according to claim 1 characterized by joining the 1st printed-circuit board with which said printed-circuit board constitutes said heights, and the 2nd printed-circuit board which constitutes said flange.

[Claim 3]

Said the 1st and said 2nd printed-circuit board are a surface mount mold piezo oscillator according to claim 2 characterized by being the printed-circuit board constituted from a mutually different insulating material.

[Claim 4]

The surface mount mold piezo oscillator according to claim 3 characterized by said 2nd printed-circuit board being a flexible printed circuit board.

[Claim 5]

It is the surface mount mold piezo oscillator which has the structure covered with said covering after having a printed-circuit board for mounting a piezoelectric transducer, the electronic parts for oscillator circuits for constituting an oscillator circuit, the electronic parts for equalization circuits for constituting an oscillation frequency equalization circuit, and said piezoelectric transducer and said electronic-parts group at least, and metal covering which has the crevice which carries out opening caudad and mounting said piezoelectric transducer and said electronic parts for equalization circuits in one principal plane of said printed-circuit board,

The surface mount mold piezo oscillator characterized by having formed the slot near the field which mounts one said piezoelectric transducer and said electronic parts for equalization circuits of a principal plane of said printed-circuit board.

[Claim 6]

The surface mount mold piezo oscillator according to claim 5 characterized by having formed so that said slot may surround each field which mounts said piezoelectric transducer and said electronic parts for equalization circuits.

[Claim 7]

The surface mount mold piezo oscillator according to claim 5 or 6 characterized by said slot preparing for the principal plane side of another side of said printed-circuit board.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to the surface mount mold piezo oscillator which solved the various nonconformities generated when connecting this piezo-electric device to an external mounting substrate about the surface mount mold piezo-electricity device used as an oscillator etc.

[0002]

[Description of the Prior Art]

By rapid progress of low-pricing accompanying the spread of mobile communication equipment, such as a portable telephone, and a miniaturization, the demand of low-pricing and a miniaturization is increasing also to the crystal oscillator used for such communication equipment.

[0003]

There are some which were indicated by JP,62-188813,U in the conventional piezo oscillator, and drawing 7 is drawing of longitudinal section showing the configuration of the package.

So that clearly from this drawing the conventional piezo oscillator 100 The piezoelectric transducer 102 with which the insulating circuit board 101 and this insulating circuit board 101 were equipped, The circuit element 103 which constitutes an oscillator circuit with this piezoelectric transducer 102, and the covering 104 which covers the circuit board 101 and seals said oscillator circuit, The terminal 105 which is installed by the circuit board 101 and makes connection with said oscillator circuit and external mounting substrate (hermetic) is provided, and it has the structure of preparing the gap of fixed spacing through the buffer ring 106, and connecting the circuit board 101 and a terminal 105 mechanically and electrically. the internal stress generated at the time of contraction (coagulation) of solder when the operation effectiveness of said buffer ring 106 carries out solder mounting of said piezo oscillator 100 at an external mounting substrate (un-illustrating) -- or it is for controlling the stress-strain diagram (heat distortion) by the coefficient-of-thermal-expansion difference of said circuit board 101 and said mounting substrate.

[0004]

[Patent reference 1] JP,62-188813,U.

[0005]

[Problem(s) to be Solved by the Invention]

In order to satisfy want to a miniaturization in recent years, in the present piezo oscillator, the so-called surface mount type which deletes said buffer ring 106 and said terminal 105, and said circuit board 101 joins to said mounting substrate directly of piezo oscillator is in use. By having deleted the buffer ring 106, however, by said heat distortion As shown in drawing 8 , curvature arises in the circuit board 111 which constitutes the piezo oscillator 120 of a surface mount mold. Between this circuit board 111 and the external mounting substrates 121, Stray capacity changes with the gaps 118

produced between the mounting pattern 117 of the piezoelectric transducer 112 and circuit element 113 with which the circuit board 111 equips a detail, and the shielding layer 122 formed in the mounting substrate 121 at a inner layer (increment). There is a possibility of changing the output frequency of a piezo oscillator 120.

[0006]

It aims at offering the surface mount mold piezo oscillator which eases the effect of heat distortion while this invention is made in order to solve the above-mentioned technical problem, and it corresponds to a miniaturization.

[0007]

[Means for Solving the Problem]

In order to solve the above-mentioned technical problem, invention according to claim 1 concerning this invention The electronic parts for oscillator circuits for constituting a piezoelectric transducer and an oscillator circuit at least, The printed-circuit board for mounting the electronic parts for equalization circuits, and said piezoelectric transducer and said electronic-parts group for constituting an oscillation frequency equalization circuit, The flange which is equipped with metal covering which has the crevice which carries out opening caudad, and equips the principal plane of another side with an external terminal while forming in the heights and this heights periphery which protrude on one principal plane of said printed-circuit board is formed. It has the structure which mounts said piezoelectric transducer and said electronic parts for equalization circuits in these heights at least, and covers the upper part of these heights with said covering.

[0008]

Moreover, invention according to claim 2 is characterized by joining the 1st printed-circuit board with which said printed-circuit board constitutes said heights, and the 2nd printed-circuit board which constitutes said flange in claim 1.

[0009]

Moreover, invention according to claim 3 is characterized by said the 1st and said 2nd printed-circuit board being a printed-circuit board which has a mutually different insulating material in claim 2.

[0010]

Moreover, invention according to claim 4 is characterized by said 2nd printed-circuit board being a flexible printed circuit board in claim 3.

[0011]

Moreover, the electronic parts for oscillator circuits for invention according to claim 5 to constitute a piezoelectric transducer and an oscillator circuit at least, The printed-circuit board for mounting the electronic parts for equalization circuits, and said piezoelectric transducer and said electronic-parts group for constituting an oscillation frequency equalization circuit, It is the surface mount mold piezo oscillator which has the structure covered with said covering after having metal covering which has the crevice which carries out opening caudad and mounting said piezoelectric transducer

and said electronic parts for equalization circuits in one principal plane of said printed-circuit board. It is characterized by having formed the slot near the field which mounts one said piezoelectric transducer and said electronic parts for equalization circuits of a principal plane of said printed-circuit board.

[0012]

Moreover, invention according to claim 6 is characterized by having formed so that said slot may surround each field which mounts said piezoelectric transducer and said electronic parts for equalization circuits in claim 5.

[0013]

Moreover, invention according to claim 7 is characterized by said slot preparing for the principal plane side of another side of said printed-circuit board in claim 5 or 6.

[0014]

[Embodiment of the Invention]

Hereafter, this invention is explained to a detail based on the gestalt of operation of illustrated this invention.

[0015]

Drawing of longitudinal section in which drawing 1 (a) shows the configuration of the crystal oscillator as a surface mount mold piezo oscillator of the 1st operation gestalt of this invention, and drawing 1 (b) are the plans in the condition of having omitted covering.

The quartz resonator 2 of the surface mount mold which has the structure which holds the temperature compensated crystal oscillator 1 of the 1st operation gestalt in the cavity which a ceramic package equips with a Xtal oscillating component, and carries out the hermetic seal of this cavity with a metal lid, The electronic parts 3 for oscillator circuits for constituting an oscillator circuit, and the electronic parts 4 for compensating circuits for constituting a temperature-compensation circuit, The printed-circuit board 7 (hereafter, when there is no assignment of a special insulating material, a glass epoxy printed-circuit board is shown.) made from the glass epoxy for mounting the electronic parts 5 for equalization circuits, and said quartz resonator 2 and said electronic-parts group for constituting an oscillation frequency equalization circuit It has the metal covering 8 which has the crevice which carries out opening caudad. Annular flange 7b formed in the principal plane (underside) side periphery of another side of heights 7a which protrudes in the center of abbreviation of one principal plane (top face) of said printed-circuit board 7, and this heights 7a is formed in one. While arranging electrode pad 6a said quartz resonator 2 and for said electronic-parts 5 mounting for equalization circuits in the top face of heights 7a at least, shielding layer 6c is arranged in the inner layer part corresponding to this heights 7a at least. While arranging said electronic parts 3 for oscillator circuits, and said electrode pad 6b for electronic-parts 4 mounting for compensating circuits in the top face of flange 7b, 6d of external terminals which carry out an electric flow is arranged in the principal plane of another side of this flange 7b at

the electrode pads 6a and 6b and shielding layer 6c. It has the structure which covers the upper part of said heights 7a which mounted a quartz resonator 2 and the electronic parts 5 for equalization circuits at least with said covering 8 after mounting said quartz resonator 2 and said electronic-parts group in said electrode pads 6a and 6b. Relaxation, i.e., this flange 7b, is made to transform said heat distortion by heat distortion by making it such structure at flange 7b, and it is made for heat distortion to have not affected heights 7a which mounted the quartz resonator 2 with the sharp sensibility to heat distortion, and the electronic parts 5 for equalization circuits.

[0016]

Drawing 2 is drawing of longitudinal section showing the configuration of the crystal oscillator as a surface mount mold piezo oscillator of the 2nd operation gestalt of this invention.

The point that the crystal oscillator of the 2nd operation gestalt differs from the 1st operation gestalt is in the point which constituted said printed-circuit board combining two printed-circuit boards. The circuit board which carried out patterning of the wiring for the polyimide film to the base material as shown in drawing 2 , the so-called center of abbreviation of flexible printed circuit board (2nd printed-circuit board) 27b -- this -- printed-circuit board (1st printed-circuit board) 27a which has an area smaller than 2nd printed-circuit board 27b by connecting mechanically and electrically 1st printed-circuit board 27a is heights 17a (it is equivalent to said heights 7a.). becoming -- this -- the part with which 1st printed-circuit board 27a and 2nd printed-circuit board 27b do not lap -- flange 17b (it is equivalent to said flange 7b.) It becomes. Relaxation, i.e., flange 17b, is made to transform by heat distortion by 2nd printed-circuit board 27b (flange 17b) equipped with high crookedness and high folding endurance for said heat distortion by making it such structure, and it is made for heat distortion to have not affected 1st printed-circuit board 27a (heights 17a) which mounted said quartz resonator 2 with the sharp sensibility to heat distortion, and said electronic parts 5 for equalization circuits. In addition, shielding layer 26c is formed in 1st printed-circuit board 27a at least.

[0017]

Drawing 3 (a) and (b) are the bottom views of the printed-circuit board concerning the crystal oscillator as a surface mount mold piezo oscillator of the 3rd operation gestalt of this invention.

The point that the crystal oscillator of the 3rd operation gestalt differs from the 1st and 2nd operation gestalten is in the point in which the slot was formed in the gap of the field corresponding to said heights which it has in the principal plane of another side of a printed-circuit board, and said external terminal. a field 37a corresponding to the field (field which mounts said quartz resonator and said electronic parts for equalization circuits) which is equivalent to said heights on both sides of rectangle plate-like the center 37 of abbreviation, i.e., this printed-circuit board, of a principal plane (underside) of a printed-circuit board 37, and 6d [of said external terminals] gap -- at least (it can

set to a printed-circuit board 37), as shown in drawing 3 (a), slot 39a is formed in the direction of a short hand at the direction of a short hand, or a longitudinal direction. [of another side] Moreover, as shown in drawing 3 (b), when field 30a which mounts said quartz resonator, and field 30b which mounts said electronic parts for equalization circuits did not approach, namely, fixed spacing is separated and it is arranged, the slots 39b and 39c which surround each of these fields 30a and 30b are formed. Slot 39a thru/or 39c of relaxation, i.e., thin meat, is made to transform said heat distortion by heat distortion by making it such structure at slot 39a thru/or 39c, and he is trying for heat distortion not to affect said fields 37a, 30a, and 30b which mounted the quartz resonator 2 with the sharp sensibility to heat distortion, and the electronic parts 5 for equalization circuits, and it excels in the point that the above-mentioned operation effectiveness can be acquired with the plate-like printed-circuit board 37.

[0018]

Drawing 4 is the plan of the printed-circuit board concerning the crystal oscillator as a surface mount mold piezo oscillator of the 1st deformation implementation gestalt (4th operation gestalt) of this invention.

The point that the crystal oscillator of the 4th operation gestalt differs from the 1st operation gestalt is in the point which made thin only the insulating layer which arranges said external terminal, and its near. As shown in drawing 4 , an insulating layer [/ 6d of external terminal and near / its / the top-face side of a printed-circuit board 47] is made thin, namely, the level difference (it is equivalent to said flange 7b) section 40 is formed in four corners on top. [said] If it puts in another way, the top face of the printed-circuit board 47 except said level difference section 40 becomes said heights, and said quartz resonator and said electronic-parts group will be mounted in the top face of these heights. The level difference section 40 of relaxation, i.e., thin meat, is made to transform said heat distortion by heat distortion in the level difference section 40 by making it such structure, and it is made for heat distortion to have not affected the quartz resonator 2 with the sharp sensibility to heat distortion, and not only the electronic parts 5 for equalization circuits but said electronic parts 3 for oscillator circuits and said electronic parts 4 for compensating circuits.

[0019]

Drawing 5 is the plan of the printed-circuit board concerning the crystal oscillator as a surface mount mold piezo oscillator of the 2nd deformation implementation gestalt (5th operation gestalt) of this invention.

The point that the crystal oscillator of the 5th operation gestalt differs from the 2nd operation gestalt is in the point which arranged only said external terminal in the tooth space of said 1st printed-circuit board and said 2nd printed-circuit board not lapping. The principal plane of another side of the part with which 2nd printed-circuit board 57b and 1st printed-circuit board 57a do not lap as shown in drawing 5 , i.e., the part equivalent to said flange 17b, (underside.) The other side of this Fig. The flange 50

tongue-shaped by arranging 6d of said external terminals, and deleting parts other than 6d of this external terminal and its near is formed. Said quartz resonator and said electronic-parts group will be mounted in one principal plane of said 1st printed-circuit board 57a, and deform said heat distortion by relaxation, they make them deform a flange 50 by heat distortion by the flange 50, and it is made for heat distortion to have not affected the quartz resonator 2 with the sharp sensibility to heat distortion, and not only the electronic parts 5 for equalization circuits but said electronic parts 3 for oscillator circuits and said electronic parts 4 for compensating circuits. Since a flange 50 is tongue-shaped, it has the operation effectiveness that deformation by heat distortion becomes still easier.

[0020]

Drawing 6 (a) - (b) is the side elevation showing the installation approach of covering concerning the crystal oscillator as a surface mount mold piezo oscillator of the 1st of this invention thru/or the 5th operation gestalt.

As shown in drawing 6 (a), covering 8 is laid so that the periphery of the crevice which said covering 8 has, and the end face of said heights 67a may contact, and flow immobilization of the tabular leg 65 which protrudes on the periphery of this covering 8, and the connection terminal 66a arranged in the end face of heights 67a is carried out with solder (un-illustrating). Moreover, as shown in drawing 6 (b), flow immobilization of the connection terminal 66b which lays covering 68 in a heights 67a top face and which is both arranged in the top face of heights 67a near the opening periphery of the crevice of this covering 68 is carried out with solder 60. Coverings 8 and 68 will function as shielding by carrying out the electric flow of these connection terminals 66a and 66b with 6d of said external terminals, and making 6d of these external terminals into ground potential.

[0021]

Although this invention was explained using the temperature compensated crystal oscillator (TCXO), it is not necessary to say that it is applicable to devices, such as SPXO, VC-TCXO, VCXO, OCXO, and a SAW oscillator.

[0022]

Moreover, this invention does not need to say that it does not limit only to a Xtal oscillating component (used quartz resonator), and can apply to the piezo-electric oscillating component (used piezoelectric transducer) of others, such as langasite, a four-way-type acid lithium, lithium tantalate, and lithium niobate. Furthermore, it is not necessary to say that it does not limit only to the printed-circuit board made from glass epoxy (except for said flexible printed circuit board (the 2nd printed-circuit board)), and can apply to the insulating material (used printed-circuit board) of others, such as a ceramic, polyimide resin, a fluororesin, and a paper phenol.

[0023]

Thus, while corresponding to a miniaturization by constituting, the surface mount mold

piezo-electricity device which eases the effect of heat distortion is obtained.

[0024]

[Effect of the Invention]

According to this invention, it has the effectiveness that it being lost that heat distortion transmits to the part which mounted the piezoelectric transducer with the sharp sensibility to heat distortion and the electronic parts for equalization circuits of this printed-circuit board even if heat distortion arises in a printed-circuit board, namely, changing the output frequency of a piezo oscillator is lost.

[Brief Description of the Drawings]

[Drawing 1] The block diagram of the crystal oscillator as 1st operation gestalt of this invention.

(a) Drawing of longitudinal section.

(b) The plan in the condition of having omitted covering.

[Drawing 2] Drawing of longitudinal section showing the configuration of the quartz resonator as 2nd operation gestalt of this invention.

[Drawing 3] The bottom view of the printed-circuit board concerning the crystal oscillator as 3rd operation gestalt of this invention.

[Drawing 4] The plan of the printed-circuit board concerning the crystal oscillator as 4th operation gestalt of this invention.

[Drawing 5] The plan of the printed-circuit board concerning the crystal oscillator as 5th operation gestalt of this invention.

[Drawing 6] The side elevation showing the installation approach of covering concerning the crystal oscillator as the 1st of this invention thru/or 5th operation gestalt.

[Drawing 7] Drawing of longitudinal section showing the configuration of the conventional crystal oscillator.

[Drawing 8] The explanatory view of the mounting nonconformity in the conventional crystal oscillator.

[Description of Notations]

1 -- Temperature compensated crystal oscillator 2 -- Quartz resonator 3 -- Electronic parts for oscillator circuits

4 -- Electronic parts for compensating circuits 5 -- Electronic parts for equalization circuits

6a, 6b -- Electrode pad 6c -- Shielding layer 6d -- External terminal

7 -- Printed-circuit board 7a -- Heights 7b -- Flange 8 -- Covering

17a -- Heights 17b -- Flange 26c -- Shielding layer

27a -- The 1st printed-circuit board 27b -- The 2nd printed-circuit board

30a, 30b -- Field 37 -- Printed-circuit board

39a, 39b, 39c -- Slot

40 -- Level difference section 47 -- Printed-circuit board 50 -- Flange

57a -- The 1st printed-circuit board 57b -- The 2nd printed-circuit board

60 -- Solder 65 -- Leg 66a, 66b -- Connection terminal
67a -- Heights Covering 68
100 120 -- Piezo oscillator 101 111 -- Circuit board
102 112 -- Piezoelectric transducer 103 113 -- Circuit element
104 -- Covering 105 -- Terminal 106 -- Buffer ring
117 -- Mounting pattern 118 -- Gap 121 -- Mounting substrate
122 -- Shielding layer